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Acknowledgements

The Alberta Department of Education acknowledges with appreciation the contributions of the Biology Ad Hoc Curriculum Committee members to the preparation of this Curriculum Guide for High School Biology. The Committee operated under the guidance of the Science Coordinating Committee and the Curriculum Policies Board.

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NOTE: This curriculum guide is a service publication only. The official statement regarding Senior High School Biology is to be found in the Senior High School Program of Studies. The information in the guide is prescriptive insofar as the content duplicates that given in the Program of Studies.

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contents

Page

Introduction 1

Objectives of Secondary School Science 2

Objectives of High School Biology 4

Biology 10

Objectives 5

Prescribed References 5

Course Outline 6
- Unit I - Student Biology Project 6
- Unit II - Cellular Biology 6
- Unit III - Organismic Biology 7

Biology 20

Objectives 8

Prescribed References 8

Course Outline 9
- Unit I - Student Ecology 9
- Unit II - Environmental Biology 9
- Unit III - Genetics 11

Biology 30

Objectives 12

Prescribed References and Guidelines For Use of Texts . . 12

Course Outline 14
- Unit I - Functional Biology 14
- Unit II - Current Biological Problems 16
- Unit III - Student Project 16

Appendices

I Bibliography 17

II Principles Governing the Use of Animals in the Classroom 39

Introduction

Literally, biology means "the study of life". In our rapidly escalating technological society, with its ever increasing population growth and the associated demands upon the environment for food and resources, there is a very real need for an awareness of the life on our planet. By a closer study of living organisms around them, it is hoped that students will develop an appreciation of life and a respect for its fragile existence.

In the curriculum outline, the objectives are such that the Biology 10 student is introduced to a survey of representatives of the major groups of living organisms. The Biology 20 student is guided through a comprehensive study of how living organisms (biotic factors) interrelate to their non-living surroundings (abiotic factors) as well as to each other. Time should be spent discussing the impact of a rapidly increasing human population, a consuming technology and the possible alleviation of these problems. The Biology 30 student studies the anatomy, physiology, and ecology of man.

At each level of the biology program the student is expected to do a project. This activity should assist in learning to identify a problem or topic for study, to analyze data, and to evaluate information in a critical and objective manner. As the courses are studied, the student is introduced to numerous biologically related fields in which he may want to choose a vocation or a leisure-time activity. Thus, it is hoped that the student will be made more aware of his world and will be better prepared to cope with problems and change that may be encountered throughout life.

OBJECTIVES OF SECONDARY SCHOOL SCIENCE

The learning of science, as an area of human endeavour, should provide the student with a scientific literacy which enables him to assume an active and useful role as a citizen in a democratic society. It may be assumed that this literacy is best achieved by considering the individual needs of students and through independent study and learning.

The objectives of Secondary School Science are:

1. To promote an understanding of the role that science has had in the development of societies:

   a. history and philosophy of science as part of human history and philosophy

   b. interaction of science and technology

   c. effect of science on health, population growth and distribution, development of resources, communication and transportation, etc.

2. To promote an awareness of the humanistic implications of science:

   a. moral and ethical problems in the use and misuse of science.

   b. science for leisure-time activities.

3. To develop a critical understanding of those current social problems which have a significant component in terms of their cause and/or their solution:

   a. depletion of natural resources

   b. pollution of water and air

   c. overpopulation

   d. improper use of chemicals

   e. science for the consumer

4. To promote understanding and development of skills in the methods used by scientists:

   a. processes in scientific inquiry such as observing, hypothesizing, classifying, experimenting and interpreting data

b. intellectual abilities such as intuition, rational thinking, creativity, and critical thinking

c. skills such as manipulation of materials, communication, solving problems in groups, and leadership.

5. To promote assimilation of scientific knowledge:

   a. emphasis on fundamental ideas

   b. relevance of scientific knowledge through inclusion of practical applications

   c. application of mathematics in science

   d. interrelationships between the sciences

   e. open-mindedness of science and the tentativeness of scientific knowledge.

6. To develop attitudes, interests, values, appreciations, and adjustments similar to those exhibited by scientists at work.

7. To contribute to the development of vocational knowledge and skill:

   a. science as a vocation

   b. science as background to technical, professional and other vocations

OBJECTIVES OF HIGH SCHOOL BIOLOGY

Students should:

1. Develop an understanding of the interdependence of living things upon themselves and upon climatic and soil factors.

2. Examine the dependence of man on his natural environment, the ways by which man is causing problems by upsetting the balance of nature, and ways by which man can live in greater harmony with nature.

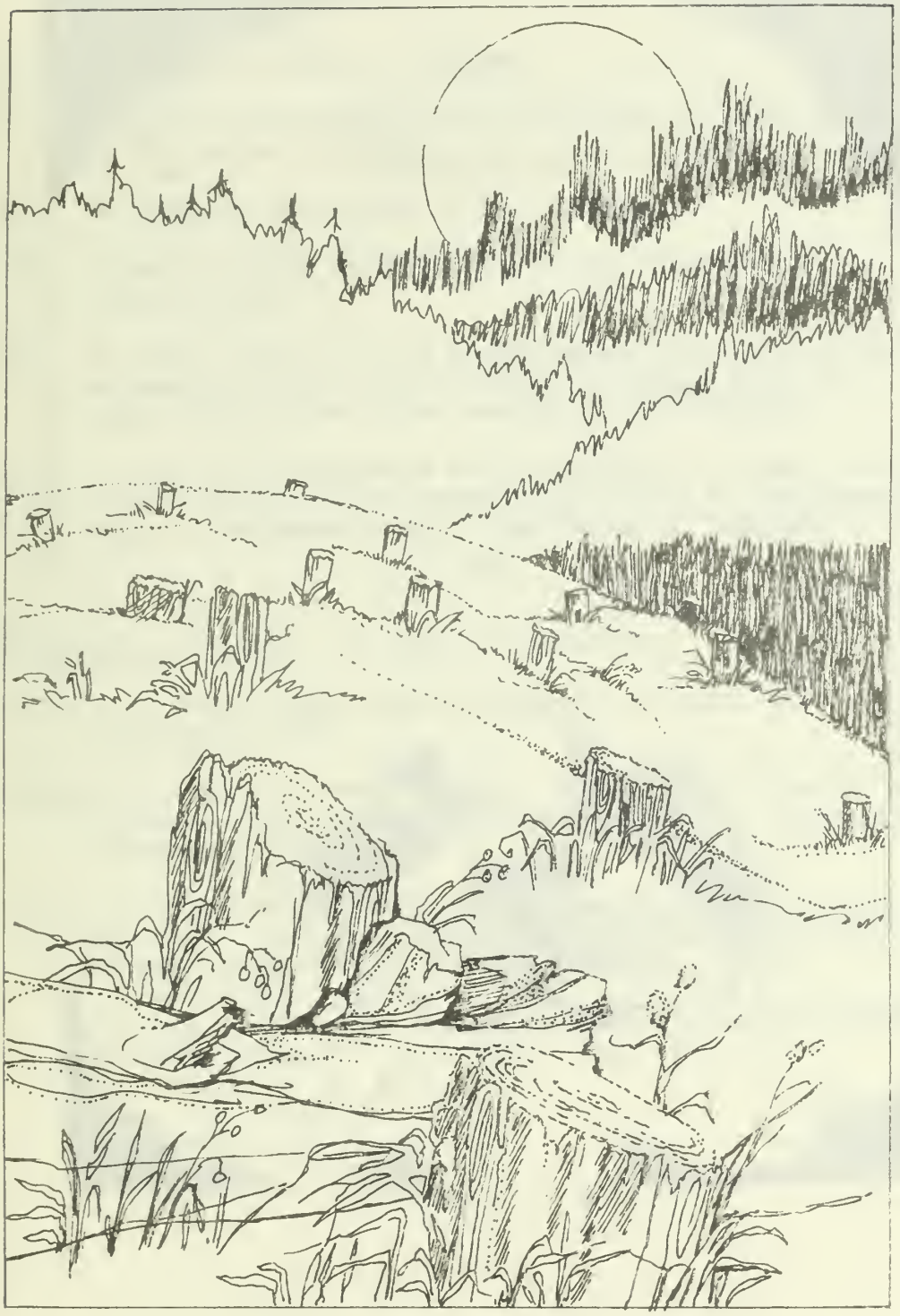
3. Investigate the major differences which exist between various life forms and apply these principles by learning to identify various bilological groups.

4. Understand the processes by which plants and animals function.

5. Learn through project and laboratory experiences the ways by which biologists carry out the field and laboratory research.

6. Develop proficiency in the use of laboratory instruments.

7. Develop an understanding of the need for using a critical, quantitative approach when looking at biological data, especially as life forms and organic material often react in ways that are less predictable than is the case with inorganic material.



BIOLOGY 10

(3 Credits)

OBJECTIVES OF THE BIOLOGY 10 PROGRAM:

10.1 To promote understanding and development of research skills by carrying out a project.

10.2 To study the principles of cell biology.

10.3 To gain a better understanding of the principles of classification.

10.4 To learn reasons for and techniques of collecting and maintaining appropriate biological specimens and to develop an appreciation of the importance of these activities.

10.5 To study the development and relationship of form, function and role in nature of the groups of life forms by the comparative study of representatives of the biological kingdoms.

Prescribed References (in order of preference)

Otto, J. H. and A. Towle, *Modern Biology*. Toronto: Holt, Rinehart and Winston, 1973

Biological Sciences Curriculum Study, *Biological Science: An Ecological Approach* - BSCS Green Version, third edition. Agincourt: Gage and Co. (Rand McNally), 1973

Biological Sciences Curriculum Study, *Biological Science: An Inquiry into Life* - BSCS Yellow Version, second edition. Don Mills: Longman Canada (Harcourt Brace Jovanovich), 1968

The Laboratory Manual of this program is also to be used with Otto and Towle.

COURSE OUTLINE FOR BIOLOGY 10

UNIT I Student Biology Project (about 10 hours)

The project may be on any biological topic but it should involve laboratory and or field investigation and the presentation of a report. (Refer to the *Student Project Handbook* for further guidance).

UNIT II Cellular Biology (about 5 hours)

	Otto & Towle 1973	BSCS Green 1973	BSCS Yellow 1968
1. Cell theory			
a. historical aspects	pp. 58-72	pp. 345-351	pp. 38-53
b. current cell theory	Labs: (from BSCS Yellow)	Lab: 11.1	108-118 122-126
2. Cellular organization and specialization	1.2, 3.1 3.2, 3.3		Labs: 1.2, 3.1 3.2, 3.3

a. cells
b. tissues
c. organs
d. organ systems

3. Cell structure and function

a. cell wall and cell membrane
b. cytoplasm
c. nucleus
d. cytoplasmic organelles

UNIT III Organismic Biology (about 50 hours)

	Otto & Towle 1973	BSCS Green 1973	BSCS Yellow 1968
1. Classification	pp. 220-229 Labs:(BSCS Yellow) 17.2, 18.1A 19.1	pp. 89-176 Labs: 4.1, 4.2 5.1, 5.2	pp. 348-354 Labs: 17.2, 18.1A 19.1
a. Principles i. bases of classification ii. binomial nomenclature			
b. Collecting and preserving techniques			
c. Making and using dichotomous keys			
2. Biological Kingdoms			
a. Phylogeny - taxonomic alternatives b. The classification, morphology, life cycles, comparative anatomy and role in nature of life forms are to be studied through an examination of selected representatives of: i. Monera ii. Protista iii. Plantae iv. Animalia	pp. 231-617 Labs: (BSCS Yellow) 9.1, 10.2, 11.1 12.2, 13.1, 13.2, 14.1, 14.2, 14.3, 15.2, 15.6, 16.1, 16.2, 17.1, 17.3, 18.2, 18.3, 18.6, 19.2, 19.3, 27.1, 27.2,	pp. 722-725 102-198 399-439 446-459 464-465 519-550 Labs: 4.3, 6.1 6.3, 6.4	pp. 354-387 177-286 296-347 354-371 762-819 Labs: same as outlined under Otto & Towle

BIOLOGY 20

(3 Credits)

OBJECTIVES OF THE BIOLOGY 20 PROGRAM:

20.1 To develop an understanding of the principles of ecology.

20.2 To investigate selected principles of ecology by carrying out a research project.

20.3 To study the principles of genetics.

20.4 To explore current critical environmental problems.

Prescribed References (in order of preference)

Biological Sciences Curriculum Study, *Biological Science: An Ecological Approach* - BSCS Green Version, third edition. Agincourt: Gage and Co. (Rand McNally),1973

Biological Sciences Curriculum Study, *Biological Science: An Inquiry Into Life* - BSCS Yellow Version, second edition. Don Mills: Longman Canada (Harcourt Brace Jovanovich), 1968 The Laboratory manual of this program is also to be used with Otto and Towle.

Otto, J. H. and A. Towle, *Modern Biology*. Toronto: Holt, Rinehart and Winston, 1973

COURSE OUTLINE FOR BIOLOGY 20

UNIT I Student Ecology Project (about 15 hours)

The project topic may be in any area of ecology but should involve laboratory and/or field investigation and the presentation of a report.
(Refer to the *Student Project Handbook* for further guidance).

UNIT II Environmental Biology (about 30 hours)

	BSCS Green 1973	Otto & Towle 1973	BSCS Yellow 1968
1. Ecological Interrelationships and Interactions	pp. 3 - 86 201 - 308 661 - 697		
a. Biotic factors			
b. Abiotic factors			
c. Interaction between biotic and abiotic factors	Labs:		
i. food chains	1.1, 1.2, 1.3,		
ii. food webs	1.4, 2.1, 2.2,		
iii. energy transfers	2.3, 2.4, 3.1,		
	3.2, 7.1, 7.2,		
	7.3, 7.4, 8.1,		
2. Biogeochemical cycles	8.2, 8.3, 9.1,		
	9.2		
a. Carbon - oxygen			
b. Water			
c. Nitrogen			
d. Calcium			
3. Individuals, Populations and Species			
a. Characteristics of populations			
b. Population changes			
c. Factors influencing populations			
4. Communities, Ecosystems and Biomes			
a. Ecosystem structure			
i. communities			
ii. niches			
iii. habitats			
b. Nutritional relationships			
i. symbioses			
ii. predation			
iii. competition			
iv. saprophytism			

c. Biomes
   i. microbial communities
   ii. terrestrial biomes
   iii. aquatic biomes

d. Biological succession
   i. pioneer species
   ii. pioneer community
   iii. climax community

5. Man and the Environment

a. Effect of population growth
b. Management of resources
c. Pollution
d. Political, social and economic factors

UNIT III Genetics (about 20 hours)

	BSCS Green 1973	Otto & Towle 1973	BSCS Yellow 1968
1. Mitosis and Meiosis	pp. 356-362 527-530	pp. 108-197	pp. 127-173
a. Phases of these processes		Labs: 7.1,	521-567
b. Significance	Labs: 11.3, 16.2, pp. 559-604	29.1, 29.2, 29.3, 29.4, 30.1, 30.2, 32.3, 32.4	
2. Heredity	Labs: 17.1,		
a. Mendelian inheritance	17.2, 17.3,		
b. Chromosome theory	17.4, 17.5		
c. Principles of genetics			
i. multiple alleles			
ii. linkage and crossing-over			
iii. non-disjunction			
3. DNA and RNA			
a. Structure and function			
b. DNA replication	pp. 605-636	pp. 198-219	pp. 568-606
c. Protein synthesis	Labs: 18.1, 18.2, 18.3		
4. Mechanisms of Genetic Change			
a. Theories of evolution - historical aspects			
b. Environmental influences on genes			
c. Mutations and gene frequency changes			
d. Speciation, geographic and reproductive isolation			

BIOLOGY 30

(5 credits)

OBJECTIVES OF THE BIOLOGY 30 PROGRAM:

30.1 To study the following processes:

a. Ingestion and absorption of raw materials, food and gases
b. Movement of materials
c. Elimination and excretion
d. Photosynthesis and other syntheses
e. Digestion
f. Energy relationships including respiration
g. Sensitivity and movement; nervous and hormonal control
h. Reproduction

30.2 To study and discuss relevant current biological problems.

30.3 To further develop investigative skills and understanding by carrying out a research project.
(Refer to the *Student Project Handbook* for further guidance).

Prescribed References

Kimball, J. W., *Biology*, (3rd ed.). Don Mills: Addison-Wesley, 1974

McElroy, W. D., et al, *Foundations of Biology*. Scarborough: Prentice-Hall, 1968

Abramoff, P. and Thompson, R. G., *Investigations of Cells and Organisms*. Scarborough: Prentice-Hall, 1968

Wagner, R. H., *Environment and Man*, (2nd ed.). Toronto: George J. McLeod, Ltd., 1974

Calgary and District Biology Teachers' Association, *Investigations in Biology*. Don Mills: Addison-Wesley, 1977

IMPORTANT GUIDELINES FOR USE OF TEXTS

1. Stress principles and bring in details only to develop the ideas.

2. Memorization of structural formulae for chemicals and of minute detail should be minimized.

3. Stress plants and man. Other life forms should be given general coverage only.

4. Students should be encouraged to read the texts extensively in order to obtain a wide perspective of biology.

5. Historical aspects should be given general coverage only.

6. As Kimball's coverage is more extensive than that of McElroy et al, teachers should use discretion regarding the depth of treatment and level of understanding of particular topics that they will require of the students.

COURSE OUTLINE FOR BIOLOGY 30

UNIT I Functional Biology (about 75 hours)

	McElroy (Pages)	Abramoff (Labs)	Kimball (Pages)	Investigations in Biology (Labs)
1. Physical properties of cells		15		
a. Chemistry of Cells	194-211	16	25-66	
i. review of background chemistry		17		
ii. biochemistry of cells				
b. Physical processes	220-235	13	99-123	
i. diffusion and osmosis				
ii. active transport				
iii. endocytosis and exocytosis				
iv. enzyme function				
2. Nutrition				
a. Autotrophic nutrition		19, 21,	158-181,	
i. absorption and transport of water, minerals and gases	488-503	22, 23	222-227, 284-297	
ii. translocation of nutrients	258-265, 465-467			
iii. photosynthesis	478-488			
iv. chemosynthesis				
b. Heterotrophic nutrition	660-671	24	124-139	
i. alimentation		25		
ii. absorption				
3. Circulation in Animals				
a. Heart and blood vessels	612-633	33	247-275	
b. Blood and blood function		35		
c. Lymph and lymph function				
d. Control of circulation				

	McElroy (Pages)	Abramoff (Labs)	Kimball (Pages)	Investigations in Biology (Labs)
4. Gas Exchange				
a. Mechanism of breathing	634-647		227-246	
b. Exchange and transport of gases			263-265	
c. Control of gas exchange				
5. Cellular Respiration	236-257	28	140-157	
a. Energy release				
i. aerobic respiration				
ii. anaerobic respiration				
b. Energy Utilization	265-268		619-634	
i. Muscular contraction	586-593 579-585			
ii. absorptive activity				
iii. electrochemical activity				
6. Excretion	648-659		302-316	
a. Kidney function				
b. Body fluid balance				
7. Metabolic Controls	564-573		497-634	
a. Genetic control of hormones and nervous responses				
b. Hormonal		38		
i. plants	511-525	39,48		
ii. animals	536-547 672-687	49		
c. Nervous	594-611			
i. receptors	688-707			
ii. conductors				
iii. effectors				
8. Human Reproduction	708-722		442-447	

UNIT II Current Biological Problems (about 20 hours)

A large number of books are now available in this area. Although some are quite good, most are superficial, out-of-date, or only cover a portion of the topic area. The text *Environment and Man* by R. Wagner seems to be the best single source currently available. While this source can be used alone, many of the examples relate to American situations; teachers are therefore encouraged to add pertinent material of local relevance. Related laboratory and/or field studies should be undertaken.

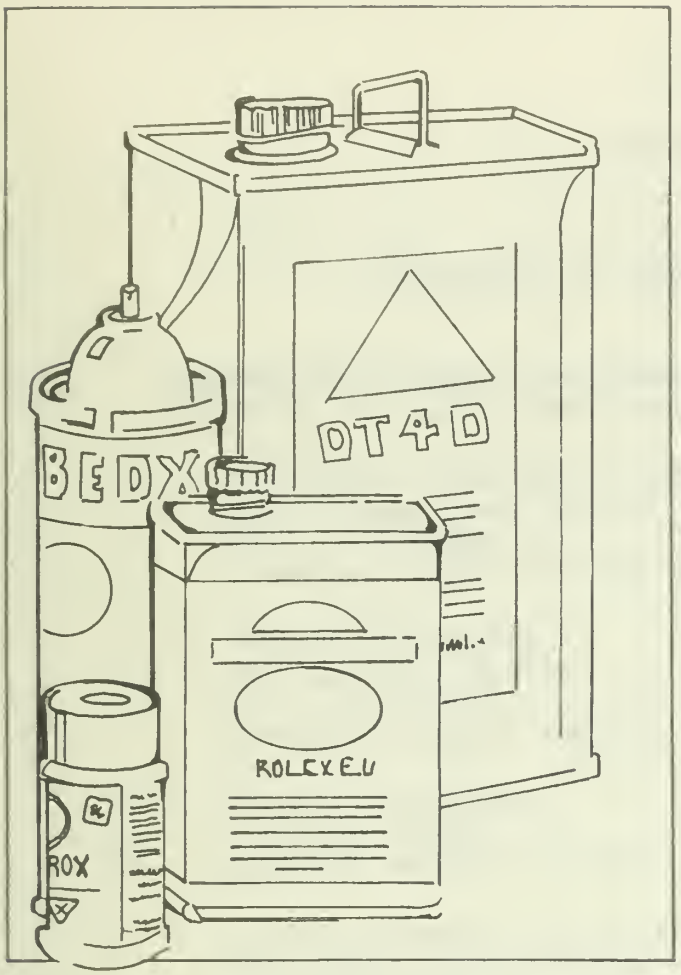
The first 20 pages of the book can be ignored as no current biological problems are discussed. The remainder of the book does, however, provide an informative and interesting description of the many ways by which man has created problems by disrupting nature and is faced with even more serious problems in the future as the human population increases. It is imperative that our students learn to recognize these problems and to learn about ways in which they may be overcome.

While all of the material in Chapters 2 through 22 is worthy of study, time constraints are such that each teacher should feel free to choose those topics which he/she feels are of greatest relevance to the local students.

The final chapter, "Population Control" raises a number of viewpoints which can be regarded as contentious. Teachers and students are encouraged therefore, to examine carefully all material before accepting a statement as being valid.

UNIT III Student Project (about 25 hours)

Each student is expected to engage in a project to complete this program as in Biology 10 and 20. The project may be in any area related to biology. Encouragement may be given to have students investigate current biological problems or other topics that may focus on scientific sociological, economic and political factors.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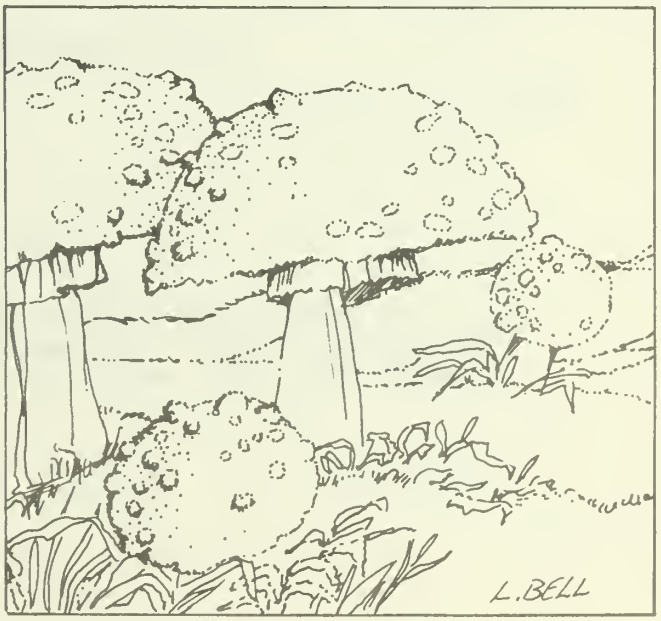
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APPENDIX I

BIBLIOGRAPHY OF SUGGESTED RESOURCE BOOKS

Teachers are reminded that numerous resource publications are available from various government agencies.

1. Environment Conservation Authority
   2100 College Plaza Tower 3
   8215 - 112 Street
   EDMONTON, Alberta T5G 2M4

2. Alberta Agriculture
   Publications, Room 4B
   9718 - 107 Street
   EDMONTON, Alberta T5K 2C8

3. Alberta Environment
   (See Note below)
   EDMONTON, Alberta T5J 0Z6

4. Alberta Recreation, Parks and Wildlife
   Fish and Wildlife Division
   9833 - 109 Street
   EDMONTON, Alberta T5K 2E1

5. Alberta Energy and Natural Resources
   9915 - 108 Street
   EDMONTON, Alberta T5K 2G8

6. Alberta Social Services and Community Health
   Publications, 7th Floor
   9915 - 108 Street
   EDMONTON, Alberta T5K 2G8

7. Environment Canada
   OTTAWA, Ontario K1A 0H3

NOTE: A more complete listing of agencies may be found in *Environmental Fact Seeker's Guide* available from Communications Branch, Alberta Environment, Oxbridge Place, 9820 - 106 Street, EDMONTON, Alberta.

SUGGESTED RESOURCE BOOKS

These resources are recommended as reference materials on topics dealing wtth current biological problems.

Adshead, P. C. et al, *On the Hydras of Alberta and the Northwest Territories:* National Museum Canada, Bull. 199, Information Canada, Ottawa, 1963

Alberta Education. *Student Project Handbook.* Alberta Education, 1976

Alberta Farm Guide, 1976. Alberta Agriculture. Available from Alberta School Book Branch, 1976

Alberta Naturalist. Journal of the Federation of Alberta Naturalists, Box 1472, Edmonton, Alberta

Alexander, R. D. *Singing Insects. Four Cases in the Study of Animal Species.* Gage, Scarborough, Ont., 1976

Alexopoulos, C. J., *Introductory Mycology,* (2nd ed.). Wiley, Rexdale, Ontario, 1962

Alexopoulos, C. J., and H. C. Bold. *Algae and Fungi.* MacMillan, Toronto, 1967

**Alternatives, Perspectives on Society and Environment.* Traill College, Trent University, Peterborough, Ontario.

**American Biology Teacher.* Journal of the National Association of Biology Teachers. 11250 Roger Bacon Drive, Reston, Virginia 22090.

American Institute of Biological Sciences, BSCS Pamphlets 1-23, *Biological Sciences Curriculum Study.* Educational Programs Improvement Corporation, P. O. Box 3406, Boulder, Colorado 80302.

*Anderson, D. T. et al. *Soil Erosion by Wind.* Canada Dept. of Agriculture, Publ. 1266, Information Canada, Ottawa, 1966.

Anderson, E. *Plants, Man and Life.* Univ. California Press, Berkeley, 1967.

Anderson, R. M. *Methods of Collecting and Preserving Vertebrate Animals.* (4th ed., rev.) Information Canada, Ottawa, 1972.

*These resources are recommended as reference materials on topics dealing with current biological problems.

Andrews, W. A. (ed.) *Contours: Studies of the Environment.* Prentice-Hall, Scarborough, Ontario.
1. *A Guide to the Study of Freshwater Ecology,* 1972
2. *A Guide to the Study of Environmental Pollution,* 1972
3. *A Guide to the Study of Soil Ecology,* 1973
4. *A Guide to the Study of Terrestrial Ecology,* 1974
5. *A Guide to Urban Studies,* 1976

Anonymous. *Biology Today.* C. R. M. Books, Del Mar, California, 1972

*Anonymous. *Pesticides: Their implications for Agriculture.* Information Canada, Ottawa, 1973

Ardrey, *Territorial Imperative,* Dell, Toronto, 1968

Arditti, J., and A. Dunn. *Experimental Plant Physiology,* Holt, Rinehart and Winston, Toronto, 1969

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Asimov, I. *The Bloodstream: River of Life.* Collier-Macmillan, Galt, Ont., 1962

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_____. *The World of Nitrogen.* Collier-Macmillan, Galt, Ont., 1962

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Balinsky, B. I. *An Introduction to Embryology.* Saunders, Toronto, 1975

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Bandoni, R. J., and A. F. Sczawinski. *Guide to Common Mushrooms of British Columbia.* B. C. Provincial Museum Handbook 24, Queen's Printer, B. C., 1964

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*Bates, M. *Man in Nature*. (2nd ed.). Prentice-Hall, Scarborough, Ont., 1964

_____. *The Forest and the Sea*. Vintage Books, Random House, Toronto, 1966

Beckner, M. *The Biological Way of Thought*. Univ. California Press, Berkeley, 1968

Beebe, W. *The Bird: Its Form and Function*. General, Don Mills, Ont. 1965

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*Bird, R. D. *Ecology of the Aspen Parkland of Western Canada in Relation to Land Use*. Information Canada, Ottawa, 1961

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*Boughey, A. S. *Readings in the Environment and Human Ecology*. Collier Macmillan Canada Ltd., Toronto, Ont., 1973

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*Brown, L. R. and G. W. Finsterbusch. *Man and His Environment: Food*. Harper & Row, New York, 1972

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*_The Calgary Field Naturalist_. Journal of the Calgary Field Naturalist Society, P. O. Box 981, Calgary, Alberta

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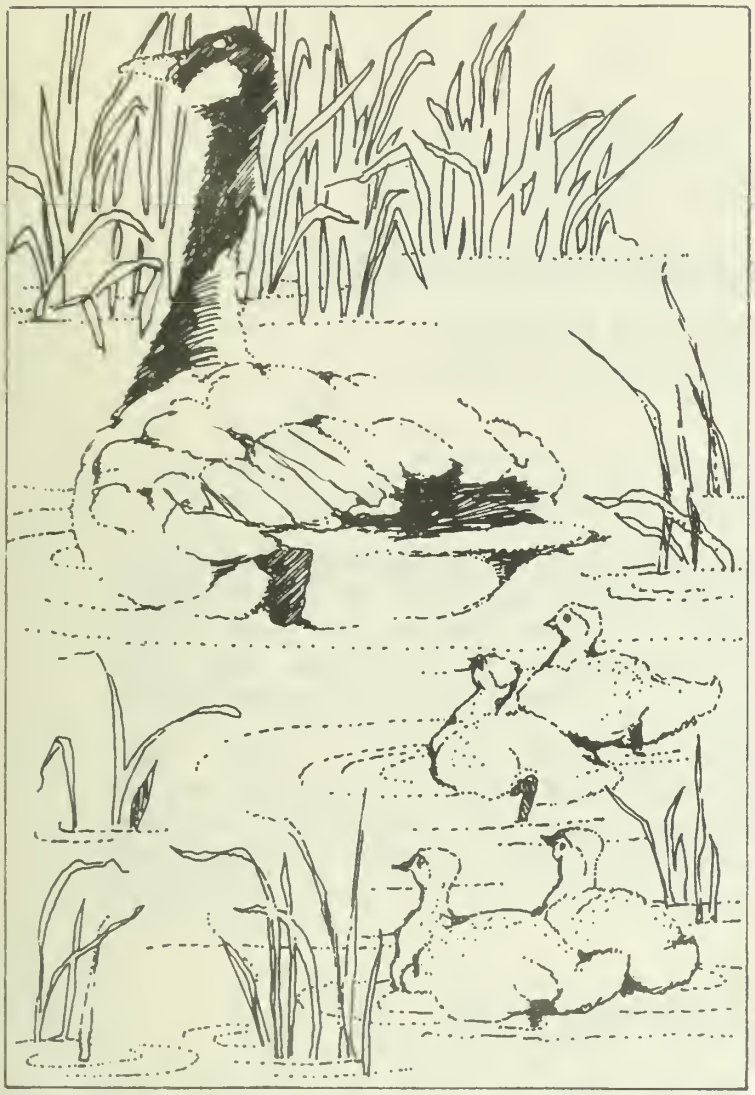


L. BELL

APPENDIX II

GUIDING PRINCIPLES GOVERNING THE USE OF ANIMALS IN THE CLASSROOM*

I. PHILOSOPHICAL CONSIDERATIONS

Biological experimentation involving animals in the classroom is essential for an understanding of living processes. Such studies should lead to a respect for all living things. All aspects of the study must be within the comprehensions and capabilities of the student undertaking the study.

Lower orders of life are preferable subjects for experimentation at the pre university level. Such lower orders as bacteria, fungi, protozoa, and insects can reveal much basic biological information; they should be used for experimentation, wherever and whenever possible.

II. CARE OF EXPERIMENTAL ANIMALS

The care of experimental animals in the school should embody the principles laid down in the Care of Experimental Animals, a Guide for Canada, as prepared and distributed by the Canadian Council on Animal Care. (151 Slater Street, Suite 1105, Ottawa, Ontario K1P 5H3.)

The following principles are necessary in order to provide optimal animal care:

a. The maintenance of animals in a classroom shared by students on a long term basis, is not recommended. Therefore, animal quarters specifically for housing of animals should be provided.

*These guiding principles have been adapted from those of the Canadian Council on Animal Care. They are recommended in order to ensure adequate safeguards exist for the proper care and use of animals for experimentation in the classroom. Students preparing projects for Science Fairs may wish to obtain a copy of the Youth Science Fair Regulations for Animal Experimentation, as prepared and distributed by the Youth Science Foundation, Suite 302, 151 Slater St., Ottawa, Ontario K1P 5H3. (Also available from Curriculum Branch, Alberta Education, Edmonton). Please specify English or French version.

b. All experimental animals used in teaching programs must be properly cared for. Animal quarters should be made comfortable by provisions for sanitation, protection from the elements and have sufficient space for normal behavioural and postural requirements of the species. The living quarters shall have surfaces that may be easily cleaned, good ventilation and lighting, well regulated temperatures and cages of sufficient size to prevent overcrowding. Animals must be protected from direct sunlight or other environmental factors which may disturb the well-being of the animal.

c. Food should be palatable, of sufficient quantity and balance to maintain a good standard of nutrition. Animals shall not be allowed to go below the maintenance level of nutrition. Clean drinking water shall be available at all times. Containers for food and water should be of a design, made specifically for that purpose.

d. Colonies and animal quarters shall be supervised by a science teacher experienced in animal care. The students and other animal care staff shall be trained and required, to handle the animals gently and humanely.

e. All animals must be disposed of in a humane manner. If euthanasia has to be carried out an approved humane method must be used and carried out by an adult experienced in the use of such procedures.

f. The use of animals must comply with existing local, provincial or federal legislation.

g. The procurement and use of wild animals and birds must comply with the Migratory Birds Convention Act of Canada, the Convention on International Trade on Endangered Species of Wild Fauna & Flora (ratified by Order in Council July 3, 1975) as well as any existing legislation at the Provincial level concerned with wild animals and exotic species.

III. EXPERIMENTAL STUDIES

1. All experiments should be carried out under the supervision of a competent science teacher. It is the responsibility of the qualified science teacher to ensure the student has the necessary comprehension for the study to be undertaken.

2. Students should not be allowed to take animals home to carry out experimental studies. All studies involving animals must be carried out in a suitable area in the school.

3. All students carrying out projects involving vertebrate animals must adhere to the following guidelines:

   A. No experimental procedures shall be attempted on a vertebrate animal that should subject it to pain or distinct discomfort, or interfere with its health.

   B. Students shall not perform surgery on vertebrate animals.

   C. Experimental procedures shall not involve the use of:

      a. microorganisms which can cause disease in man or animals.
      b. ionizing radiation.
      c. cancer producing agents.
      d. drugs or chemicals at toxic levels.
      e. alcohol in any form.
      f. drugs that may produce pain.
      g. drugs known to produce adverse reactions, side effects, or capable of producing birth deformities.

   D. Experimental treatments should not include electric shock, exercise until exhaustion, or other distressing stimuli.

   E. Behavioural studies should use only reward (positive reinforcement) and not punishment in training programs.

   F. If egg embryos are subjected to experimental manipulations, the embryo must be destroyed humanely 2 days prior to hatching. If normal egg embryos are to be hatched, satisfactory humane considerations must be made for disposal of the young birds.

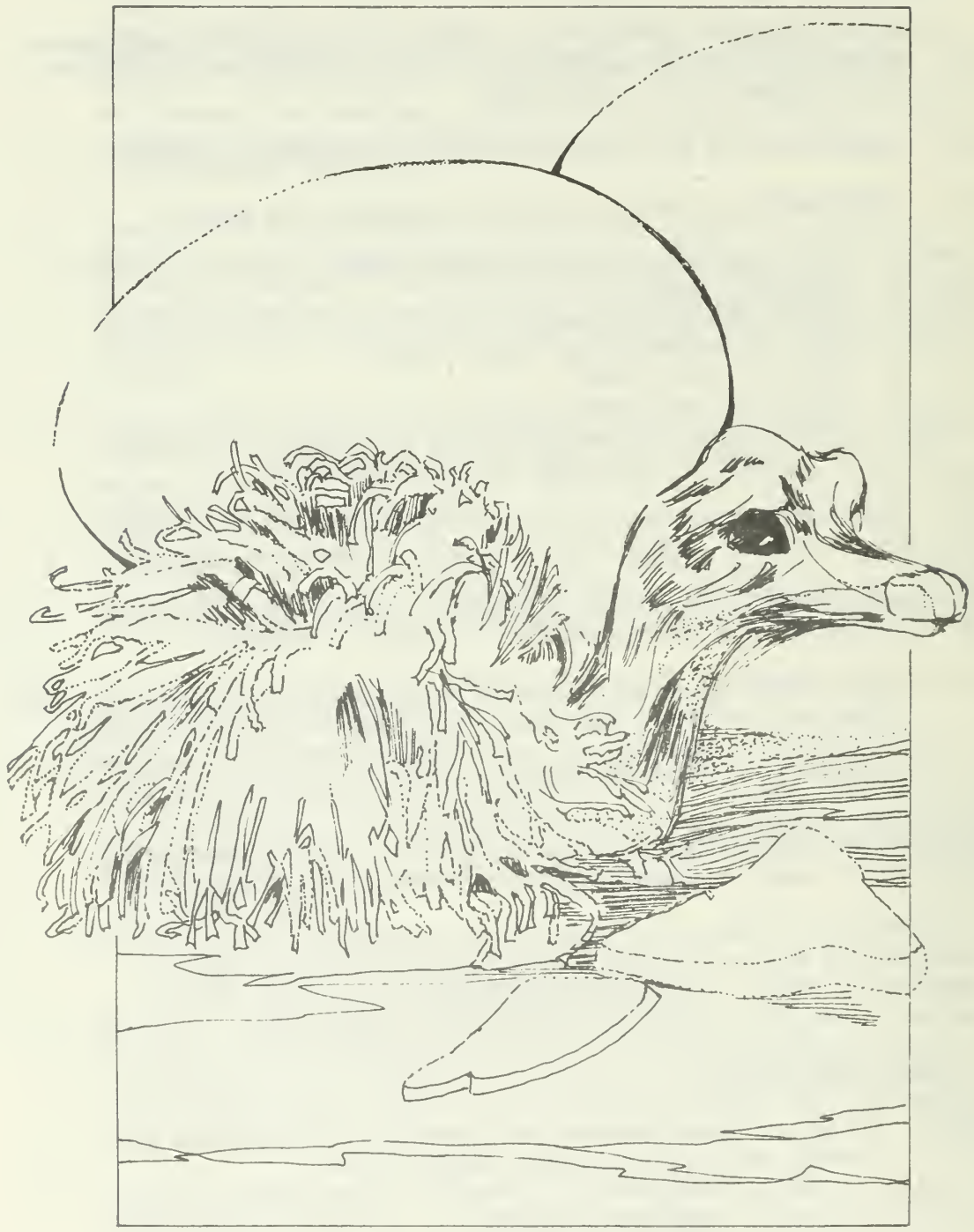
4. The use of anaesthetic agents, by students, is not recommended and in the case of some anaesthetics not permitted by law.

5. *Information on the care. housing and management for individual species, as well as suitable experiments for use at the pre university level, may be obtained from the Canadian Council on Animal Care, 151 Slater St., Suite 1105, Ottawa, Ont. K1P 5H3.

   (revised May 1975).

   NOTE: Copies of this statement of principles (in English or French) are available upon request from:

   Curriculum Branch
   Alberta Education
   Executive Building
   10105 - 109 Street
   EDMONTON, Alberta T5J 2V2



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